CLAIMS

What is claimed is:

1. A method of positioning a three-dimensional structure comprising the steps of:

establishing a virtual model, the virtual model including a three-dimensional digital representation of the structure, the virtual model being stored in a memory;

positioning remote sensors in selected positions on the structure, the remote sensors configured to provide real-time location, attitude and orientation information regarding the structure;

associating digital representations of the positions of the remote sensors with the virtual model in a data structure in the memory;

monitoring the real-time location, attitude and orientation information provided by the remote sensors;

modifying the location, attitude and orientation of the virtual model with respect to a predefined coordinate system so as to generate a real-time virtual model which corresponds to a current location, attitude and orientation of the structure;

displaying the real-time virtual model to a user as a graphical and textual representation of the current location, attitude and orientation of the structure and simultaneously displaying a graphical and textual representation of a desired location, attitude and orientation of the structure; and

adjusting the current location, attitude and orientation of the structure so as to align the current location, attitude and orientation of the structure to the desired location, attitude and orientation of the structure.

wherein the display information is displayed on the display such that a user is provided with a visual graphical representation of the present position, orientation and attitude of the structure and the desired position, orientation and attitude of the structure.

12. A precise positioning apparatus as in claim 11 further comprising a communication system, the communication system coupled to the GPS receiver and to the system bus, the communication system providing a link for communicating information from the GPS receiver to the microprocessor.

13. A precise positioning system as in claim 12 wherein the communication system comprises a two-way radio communication system.

14. A communication system as in claim 12 wherein the communication system comprises an optical communication system.

15. A precise positioning system as in claim 12 further comprising an orientation sensor, the orientation sensor generating orientation information regarding the orientation of the structure, the orientation sensor coupled to the communication system, wherein the communication system further providing a link for communicating orientation information from the orientation sensor to the microprocessor.

16. A precise positioning system as in claim 15 wherein the orientation sensor comprises a gyro compass.

17. A precise positioning system as in claim 12 further comprising an attitude sensor, the attitude sensor generating pitch information regarding the structure, the attitude sensor coupled to the communication system, wherein the communication system further providing a link for communicating the pitch information from the orientation sensor to the microprocessor.

18. A precise positioning system as in claim 17 wherein the attitude sensor further generating roll information regarding the structure, and wherein the communication system further providing a link for communicating the roll information to the microprocessor.

19. A precise positioning system as in claim 18 wherein the attitude sensor comprises a tilt meter.

20. A precise positioning system as in claim 12 further comprising a pressure sensor, the pressure sensor generating depth information regarding the structure, the pressure sensor coupled to the communication system, wherein the communication system further providing a link for communicating the depth information from the pressure sensor to the microprocessor.

21. A method of generating an as built report regarding a structure, the method comprising the steps of:

positioning remote sensors in selected positions on the structure, the remote sensors configured to provide real-time location, attitude and orientation information regarding the structure;

monitoring the real-time location, attitude and orientation information provided by the remote sensors and using the information to create a virtual representation of the structure, the virtual representation being stored in a memory of a computer system;

terminating the monitoring of the information and generating a report regarding the location, attitude and orientation of the structure using the virtual representation.

2. The method of claim 1 wherein the remote sensors include one or more GPS sensors, and wherein the step of positioning comprises the step of:

locating the GPS sensors on the structure such that one or more antennas associated with each of the one or more GPS sensors are located at strategic points on the structure so as to provide sufficient real-time position information to allow a determination of the location, attitude and orientation of the structure.

3. The method of claim 2 wherein the remote sensors further include one or more tilt meters, and wherein the step of positioning further comprises the step of:

locating the one or more tilt meters on the structure such that the tilt meters are oriented along the major axes of the structure so as to provide pitch and roll information concerning the structure during a positioning operation.

4. The method of claim 3 wherein the remote sensors further include one or more pressure sensors, and wherein the step of positioning further comprises the step of:

locating the one or more pressure sensors on the structure such that the pressure sensors are located on portions of the structure to be submerged so as to provide depth information regarding the submerged portions of the structure.

5. The method of claim 4 wherein the remote sensors further include a gyro compass, and wherein the step of positioning further comprises the step of:

locating the gyro compass on the structure such that the gyro compass is aligned with a major axis of the structure so as to provide orientation information regarding the structure.

6. The method of claim 1 wherein the remote sensors include a GPS sensor and a tilt meter, and wherein the step of positioning comprises the steps of:

locating the GPS sensor on the structure such that one or more antennas of the GPS sensor are located at strategic points on the structure so as to provide sufficient real-time position information to allow a determination of the location of the structure; and

locating the one or more tilt meters on the structure such that the tilt meters are oriented so as to provide orientation information regarding the structure.

7. The method of claim 1 wherein the remote sensors are coupled to a communication device on the structure and wherein the step of monitoring comprises the step of:

providing the real-time location, attitude and orientation information regarding the structure produced by the remote sensors to the communication device;

modulating a communication signal with the real-time location, attitude and orientation information in the communication device and transmitting the communication signal over a communication link to a base station;

receiving the communication signal at the base station and demodulating the communication signal to extract the real-time location, attitude and orientation information; and

processing the real-time location, attitude and orientation at the base station to produce update information for the virtual model.

8. The method of claim 7 wherein the step of modifying comprises the step of:

updating the virtual model using the update information so that the location, attitude and orientation of the virtual model with respect to the predefined coordinate system corresponds with the real-time location, attitude and orientation information produced by the remote sensors.

9. The method of claim 1 wherein the step of displaying comprises the steps of:

displaying the current orientation of the structure using a compass rose and pointer arrow; and

displaying the current attitude of the structure using orthogonal pitch and roll bars, each of the pitch and roll bars having associated pitch and roll cursors.

10. The method of claim 9 wherein the step of displaying further comprises the step of:

displaying a plan view of the positioning operation, the plan view showing a two-dimensional representation of the structure, the structure being represented in its current location, attitude and orientation, the plan view further showing the desired location, attitude and orientation of the structure.

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11. A precise positioning apparatus comprising:

a system bus;

a GPS receiver configured to communicate with the system bus, the GPS receiver generating position information regarding the position of a structure associated with the GPS receiver;

a memory configured to communicate with the system bus;

a display configured to communicate with the system bus;

a microprocessor configured to communicate with the system bus, the microprocessor configured to receive the position information from the GPS receiver and configured to generate display information based on the position information, the display information comprising guidance and orientation information, the microprocessor configured to transmit the display information to the display.